

### Script Concordance Test as Tool for Clinical Reasoning

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#### Abstract

**Background:** The recent observations of undergraduate teaching, has reflected that the students in their Orthopaedic training are competent in obtaining history and performing examination but poor in clinical reasoning. The study aim is to improve their clinical reasoning abilities by developing a teaching and learning tool which is the Script Concordance Test.

**Methodology:** It is prospective observational study involving year 5 students in their Orthopaedic posting (n =55), Orthopaedic Medical officers (n = 10), and Experts (n = 10) by developing quality Script Concordance test clinical vignettes, administering them online and assessing the perception of SCT.

**Results:** The ANOVA test revealed statistically significant differences among the three groups (Experts, Medical students and Medical Officers:  $p < 0.0001$ ). The Post hoc analysis indicated significant differences between students and medical officers ( $p < 0.001$ ), students and experts ( $p < 0.001$ ), and residents and experts ( $p = 0.014$ ). The Cronbach  $\alpha$  coefficient was 0.74. More than 75% of the participants found the test is of relevance and ability to improve the clinical reasoning ability.

**Conclusion:** The online orthopedic SCT is feasible, reliable, and useful for assessing clinical reasoning. This online assessment tool is valuable tool for undergraduate programs and continuing medical education.

**Keywords:** Script concordance test, Clinical reasoning

#### Introduction

Script Concordance testing (SCT) is based on the principle that the steps in the clinical reasoning process can be assessed and compared between a novice to those of a panel of experts. This SCT is a written test for assessing reasoning under conditions of uncertainty [1]. The students will be provided with sufficient clinical context that will allow them to make meaningful decisions, a certain amount of uncertainty or incompleteness is deliberately introduced into the clinical scenarios in order to simulate the ambiguous conditions that often characterize real-life clinical encounters [2]. By incorporating the SCT which tests the clinical reasoning skills and data interpretation skills as written simulations of ill defined clinical problems at the 'knows how' level along with MCQ which is testing 'knows' and 'knows how', and OCSE that tests 'shows how' in medical curriculum of our University, this is an attempt to enhance the

robustness and credibility of the assessment programme [3].

The recent observations of our undergraduate teaching, is identified that the students in their Orthopaedic training are competent in taking history and doing examination but poor in reasoning. This issue is further reflected on one based answer scoring as seen in formative assessment. Furthermore houseman in Malaysia are posted for 4 months in orthopaedics as a part of full registration with Malaysian medical council. Our university curriculum offer little opportunity to undergraduates students to expose them to orthopaedics core competencies in 2 week time as a part of hospital based practice rotation in stage 5. Our aim is to improve their clinical reasoning abilities by developing a teaching and learning tool which is the Script Concordance Test.

### **Objective**

To produce graduates with with good clinical reasoning skills when challenged with authentic clinical situations in the workplace. To develop quality Script Concordance tests (SCT) clinical scenarios as online formative assessments with feedback to improve clinical reasoning skills of undergraduates students in Orthopaedics. To evaluate the perception of the students on SCT following the implementation

### **Methodology**

This is a prospective observation study conducted in the Newcastle University among stage 5 (year 5) students 5 students in their Orthopaedic posting (n =55), Orthopedic Medical officers (n = 10), and experts (n = 10) who are the orthopaedic consultants. The following are the steps involved in the conduct of the study.

Step 1: Development of Script Concordance test clinical vignettes

These clinical scenarios will be developed based on the contents of the Musculoskeletal course objectives at

Newcastle University. About 10 clinical vignettes and 30 items are developed and made available online in the University Moodle where the students have access using their login id. Each item in the SCT clinical vignette involve a clinical decision making captured by 5 point likert scale. The scoring grid of this SCT is constructed using an aggregated score (a specific feature of this test) which will be based on the answers from a panel of 10 experts in Musculoskeletal system as shown in Figure 1. The participants will be the undergraduate students posted in the Orthopedics during their fifth year of training.

### **Construct Validity:**

A team of two Orthopaedic clinicians were involved in the construct of the clinical situations that measures the diagnostic hypothesis, investigations and management of clinical situations. About 20 case situations with 50 questions will reach reliability of 0.8 (Norman 2006). However, we developed 5 cases with 15 questions. Table 1

### **Face and content validity**

The initial 38 questions that were developed was assessed by two Orthopaedic Faculty on whether the questions addressed the realistic dilemma situations of Orthopaedics and also the Ministry of health expectations of house officer's ability to manage clinical situations at the entry of housemanship. This process allowed us to retain 30 questions to be administered to the students, medical officers (residents) and Experts.

### **Step 2: Administration of the online SCT**

The SCT was administered online to students during their stage 5 training. The time duration of the questions for one hour and 30 minutes and all the students were tested in similar environment as an online test in the computer lab. The Medical officers are the residents in their third year of training and SCT was administered face to face in the hospital seminar room. The Experts were mailed the copy

of the questions and email responses to the questions was received. Figure 1

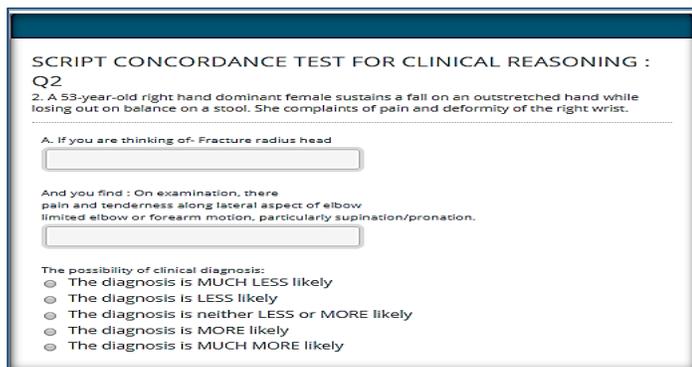


Figure 1: Online Script concordance test

### Step 3: Perception of the SCT

Once the test is completed, the participants will be given questionnaire on the perception of the effectiveness of SCT on 5-point Likert scale of agreement.

Scoring method used: Aggregate method

The SCT was scored using an aggregate method described by Norman and Norcini et al, The scoring scheme for each question is determined by the frequency with which each response is chosen by the experts [4]. To ensure that each question is given equal weight, the value assigned to each response for a given question is transformed proportionally to give a maximum score of 1 for the response chosen by most of the experts (ie, the mode); other responses are given fractional scores depending on the number of experts choosing them. Responses not chosen by experts receive a score of zero. Table 1

Formula used to calculate the final scores					
Score Key	-2	-1	0	+1	+2
No of Panel experts choosing the answer (out of 10)	7	0	0	2	1
Proportional Calculation	7/7	0/7	0/7	2/7	1/7
Student Score	1	0	0	0.29	0.14

Table 1: Sample scoring grid

## Results

The SCT was administered to 55 medical students, 10 residents’ medical officers and 10 Orthopaedic Experts. The internal reliability of the test was satisfactory (Cronbach’s  $\alpha=0.80$ ). The global mean scores are significantly different depending on the level of experiences. The following are the mean scores of the study participants. Medical Students: 39.4 % (SD:4.062), resident medical officers: 67.8% (SD: 4.708), experts: 82.6% (SD: 3.752). The ANOVA test revealed statistically significant differences among the three groups (Experts, Medical students and Medical Officers:  $p<0.0001$ ). The Post hoc analysis indicated significant differences between students and medical officers ( $p<0.001$ ), students and experts ( $p<0.001$ ), and residents and experts ( $p=0.014$ ). The Cronbach  $\alpha$  coefficient was 0.74. More than 75% of the participants found the test is of relevance and ability to improve the clinical reasoning ability.

Table 2

	Strongly Agree	Not sure	Disagree
The SCT case Vignettes depicts “real-life” clinical decision-making?”	57.8	33.3	8.9
The SCT situations fairly represented the core orthopaedics conditions as stipulated in the Numed curriculum	55.6	35.6	2
“The SCT cases covered a range of difficulty that stimulates critical thinking and problem-solving approach?”	60	35.6	2

The SCTs helped me to identify my area of weakness	60	35.6	2
The SCTs feedback has Improved my ability of self-assessment of performance	62.2	33.3	2
There was no problem with log in and access to the SCTs	68.1	28.1	0
I was able to navigate through the SCTs effectively	66.7	33.1	0
The SCT method of assessment for clinical reasoning can be incorporated in the future as formative assessment	60	35.6	2

Table 2: SCT perception

**Discussion**

The Script Concordance approach is designed to measure the quality of a set of cognitive operations or knowledge structures by comparing a participant's problem representation, judgements and choices to those of an experienced clinician's groups [5]. The clinical decisions made by doctors are the result of how they interpret and analyse data obtained from patients. This clinical reasoning process forms the basis of patient care. Our pilot study has validated the online SCT for orthopaedics for undergraduate students by comparing their judgement skills with those of experts. It has identified an area of concern with respect to our graduate preparedness. This highlights that majority of medical students has paucity of theoretical knowledge that precludes them to interpret the significance of information in different clinical contexts.

The study has identified the concern in our present medical curriculum. It has highlighted that the graduates have demonstrated low clinical reasoning ability than the residents who will soon become residents. Majority of students demonstrated paucity in their clinical reasoning. There is an evident need to improve the reflective practice of our graduates that will improve the clinical reasoning skills. Some schools have introduced portfolios as tools for reflective practice. However, there is evidence to suggest that clinical educators leading the students on how to reflect in the ward settings improve the reflective skills of both the educators and the students. This preliminary study involving 55 final year medical students has provided information on sufficient evidence of the presence of a significant degree of discordance between how doctors and students interpret clinical information. Inclusion of strategies such as script concordance test provides information and provoke students to reflect and improve their clinical reasoning ability which is the core competency that must be developed at the exit of medical school. Our study has used web based as SCT evaluation instrument as paper based. However, the web based allows evaluation to be validated over large scale over a relatively short period of time [6,7]. The participants have rated the SCT clinical scenarios as realistic and relevant that assists in improving their clinical reasoning. The study has implications to adopt SCT into teaching learning strategy in the curriculum as formative assessment tool. However, the study has numerous limitations such as difficulty in data analysis, significant delays in identifying problem trends and poor user compliance. Although SCT is an assessment tool that is able to reliably detect differences in capacity of interpreting clinical data among participants there are no reports in the educational literature on methods available to improve the performance of individuals whose test scores are low [8,

9]. Nevertheless, there is recent data demonstrating that for continuing professional development, the SCT format can be an efficient method to improve management practice [10].

**Conclusion**

The online orthopedic SCT is feasible, reliable, and useful for assessing clinical reasoning. This online assessment tool is valuable tool for undergraduate programs and continuing medical education.

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**Script Concordance Test Orthopaedics**

1. A 44-year-old man is brought to the Emergency Department 2 hours after high speed Motor vehicle collision and prolonged extrication. He complains of severe right hip pain.

Diagnostic

	If you are thinking of	and then you find that	This hypothesis becomes					
			A	B	C	D	E	
1.	Posterior dislocation of hip	On examination, the attitude of right hip is in flexed, adducted and internally rotated.	-2	-1	0	+1	+2	-2: Much less likely -1=less likely 0=neither
2.	Intertrochanteric fracture	On examination, there is normal dorsalis pedis, faint posterior	-2	-1	0	+1	+2	

		tibial. There is numbness in the right lower extremity On examination, the attitude of right limb is flexed , externally rotated so that lateral border of foot touching the couch and there is bony tenderness over greater trochanter.						more or less likely +1=more likely +2=much more likely
3.	Fracture neck of femur	On examination, the attitude of the right lower limb is slightly flexed, shortened and externally rotated.						

2. A 53-year-old right hand dominant female sustains a fall on an outstretched hand while losing out on balance on a stool. She complains of pain and deformity of the right wrist.

Diagnostic

	If you are thinking of	and then you find that	This hypothesis becomes					
4.	Fracture radius head	On examination, there pain and tenderness along lateral aspect of elbow limited elbow or forearm motion, particularly supination/pronation.	A -2	B -1	C 0	D +1	E +2	-2: Much less likely -1=less likely 0=neither more or less likely +1=more likely +2=much more likely
5.	Scaphoid fracture	On examination, there is tenderness over the anatomical snuff box.	A -2	B -1	C 0	D +1	E +2	
6.	Fracture distal radius	On examination, there is bony tenderness over the distal end radius and dinner fork deformity	A -2	B -1	C 0	D +1	E +2	

3. A 6 years old girl complains of pain in right leg since 5 days.

Clinical Management

	If you are plan of action is	and then you find that	Then your plan of action becomes					
7.	Osteomyelitis	On examination, there is bony tenderness over metaphyseal region and xray is normal	A -2	B -1	C 0	D +1	E +2	-2: Much less likely -1=less likely 0=neither more or less likely +1=more likely +2=much more likely
8.	Ewings carcinoma	On examination, there is bony tenderness over diphyseal region and xray shows onion peel type periosteal reaction.	A -2	B -1	C 0	D +1	E +2	
9.	Osteoid osteoma	Pain is relieved by taking salicylate acid. On examination, there is bony tenderness over diphyseal region and xray shows lytic foci of 5 mm.	A -2	B -1	C 0	D +1	E +2	

4. A 20 years old male complains of right knee joint pain following a bad tackle during a soccer game.

Clinical Management

	If you are plan of action is	and then you find that	Then your plan of action becomes					
10.	Medial Meniscal injury	On clinical examination, there is swelling, medial joint line tenderness and mc murray test is positive.	A -2	B -1	C 0	D +1	E +2	-2: Much less likely -1=less likely 0=neither more or less likely +1=more likely +2=much more likely
11.	Anterior cruciate ligament injury	On clinical examination, there is fullness around the knee joint and Lachman test is positive.	A -2	B -1	C 0	D +1	E +2	
12.	Posterior cruciate ligament injury	On clinical examination, there is loss of normal step off of tibia and posterior drawer test is positive.	A -2	B -1	C 0	D +1	E +2	

5. A 36 years old typist complains of pain and tingling in her fingers.

Clinical Management

	If you are plan of action is	and then you find that	Then your plan of action becomes					
			A	B	C	D	E	
13.	Carpal tunnel syndrome	On examination, there is numbness in three and half radial fingers and tinel sign is positive.	A -2	B -1	C 0	D +1	E +2	-2: Much less likely -1=less likely 0=neither more or less likely +1=more likely +2=much more likely
14.	Cubital tunnel syndrome	On examination, there is numbness in medial one and half digit and back of the hand. Froment sign and card test positive.	A -2	B -1	C 0	D +1	E +2	
15.	Guyon's canal syndrome	On examination, there is numbness in medial one and half digit and claw deformity of ring and little finger.	A -2	B -1	C 0	D +1	E +2	

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